Wisconsin Traffic Engineering Council
Issue Paper 17 – Wireless Traffic Signal Communication Technologies

Background / Overview

Rapid innovations have taken place in communication technologies in the last decade. Older technologies although slow and offer low bandwidth are robust and resilient. Newer technologies offer higher throughputs, flexible configurations and a wide range of services. Wireline technologies developed before wireless technologies allow voice, data and video communications. New communication protocols and materials have increased the data throughputs using conventional media like copper wires and coaxial cables. However, installation or leasing of wireline technologies can be expensive and time consuming. Wireless technologies have advanced exponentially and offer an alternative to wireline technologies.

Wireless Technologies

Wi-Fi (IEEE 802.11) Wireless Local Area Network (LAN)

- Wireless rates of up to 600 Mbps for 802.11n
- Operates in 2.4 or 5 GHz
- Outdoor range of about 800 ft
- Ideal for short range, high bandwidth communications
- Applications include data link among sensors, remote video cameras and roadside units
- Radio Frequency interference often a significant problem when covering large areas
- Performance limitations with large number of users
- Wireless LAN bridges support high data rates and ranges of several miles with use of line-of-sight directional antennas

Mesh Networking

- Uses patented multi-hopping technology to improve network coverage and increase throughput of 802.11 networks
- Up to 6Mbps burst data rates
- Complete mobility at highway speeds and above
- Cost-effective for LAN and WAN deployments
- Ideal for wide area coverage such as city-wide communications

WiMAX (IEEE 802.16)

- Broadband standard for Wireless Metropolitan Area Networks
- Differs from Wi-Fi in range, speed and consequently power consumption
- Signal radius of about 30 miles
- Speeds up to 1 Gbps for fixed stations

Spread Spectrum Technology

- Originally developed for military applications to provide secure communication
- 900 MHz, 2.4 GHz and 5.8 GHz bands available for unlicensed spread spectrum transmission

3G/4G Cellular

- Commercially available

	Peak Data Rate	Transmission Range (miles)	Line-of-sight requirement	Reliability
Wi-Fi (802.11)	< 600 Mbps	< 1	Yes	Medium-High
Mesh Networking (802.11)	< 300 Mbps	< 1	Yes	*
WiMAX (802.16)	< 1Gbps	< 30	No	*
900 MHz Spread Spectrum Radio	< 120 Kbps	< 15	Yes	High
2.4 GHz Spread Spectrum Radio	<200 Kbps	< 15	Yes	High
5 GHz Spread Spectrum Radio	< 100 Mbps	< 15	Yes	High
Digital Microwave	<155 Mbps	< 30	Yes	High
3G Cellular	< 2 Mbps	< 15	No	Medium
4 G Cellular	< 100 Mbps	< 15	No	*

Wireless technologies used in the US

- Los Angeles County uses Wi-MAX functional Proxim point-to-multipoint radios to control 1000 traffic signals. Estimated to save over $700,000 annually when compared to leased telephone lines
- City of Aurora, Colorado uses a mesh network from Encom to provide wireless connectivity to all 300 signal controllers. Cost savings are expected to be around $150,000 per year.
- New York City had been paying over $5,000,000 per year in phone bills for operation of traffic signals. NYC is migrating to NYCWin wireless communication network. NYCWin is an IP-based network using cellular-structured wireless technology and a licensed frequency in 2.5 GHz.
- Boulder, Colorado replaced 22 T1 lines with GE MDS Spread Spectrum Radios to communicate with 140 traffic signals. Expected payback period is one year.

Vendors

- Motorola http://www.itssiemens.com/en/t_nav115.html
- Proxim http://www.proxim.com/solutions/transportation
- Encom http://www.encomwireless.com/our-solutions/itstraffic-management
- GE http://www.ge-energy.com/products_and_services/products/industrial_strength_communications/mds_products.jsp
- Cisco http://www.cisco.com